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PATENT
3672-0111P

IN THE U.S. PATENT AND TRADEMARK OFFICE

In re application of		Before the Board of Appeals	
Thomas JACKSON et al.		Appeal No.:	
Appl. No.:	09/763,948	Group:	1637
Filed:	June 8, 2001	Examiner:	J. FREDMAN
Conf.:	3940		
For:	A MEANS FOR ELECTRICAL CONTACTING OR ISOLATION OF ORGANIC OR INORGANIC SEMICONDUCTOR AND A METHOD FOR ITS FABRICATION		

REPLY BRIEF TRANSMITTAL FORM

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

March 14, 2005

Sir:

Transmitted herewith is an Reply Brief on behalf of the Appellants in connection with the above-identified application.

☐ The enclosed document is being transmitted via the Certificate of Mailing provisions of 37 C.F.R. § 1.8.

The Examiner's Answer issued on January 14, 2005.

☐ Applicant claims small entity status in accordance with 37 C.F.R. § 1.27

The fee has been calculated as shown below:

☐ Extension of time fee pursuant to 37 C.F.R. §§ 1.17 and 1.136(a) - $0.00.

☒ No fee is due.

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Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By MA
MaryAnne Armstrong, #40,069

P.O. Box 747
Falls Church, VA 22040-0747
(703) 205-8000

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Attachment(s)

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<u>REPLY BRIEF UNDER 37 C.F.R. §41.41</u>

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REPLY BRIEF UNDER 37 C.F.R. §41.41

Sir:

The present Reply Brief is submitted in response to the Examiner's Answer issued on January 14, 2005. In the Examiner's Answer, the Examiner maintains that the device of Sato meets all the structural limitations of the claimed invention. See for example, page 5, lines 15-17, of the Examiner's Answer.

In addition, the Examiner has distilled Appellants' arguments down to the issue of whether the device of Sato contains a semi-conductor. The crux of the Examiner's position appears to be based on the assertion that because TCNQ can act as a semi-conductor under certain conditions, it meets the structural limitation of the present invention

of a semi-conductor. In this regard, the Examiner states on page 9, 1st paragraph of the Examiner's Answer that the TCNQ operates the same way in Sato as is required by claim 1. The Examiner further states that Appellants' argument that the TCNQ in Sato is not a semi-conductor reflects an "intended use" for the material. Thus, the Examiner asserts that the device of Sato can be used in the exact same way as the inventive device. Finally, on page 10 of the Examiner's Answer, the Examiner asserts that "As the amperage of the device of Sato is increased from zero, there will be inherently a point at which TCNQ will function as a semiconductor."

The present Reply Brief addresses the above points asserted by the Examiner. Specifically, the following assertions made by the Examiner are addressed herein.

1) As discussed above, the crux of the Examiner's position appears to come down to a question of whether the device of Sato can used in the same way as the inventive device, even if Sato does not disclose such use. Briefly, the answer to this question is "No".

2) In connection with 1), above, the present Reply Brief also addresses the position of the Examiner that the TCNQ in the device of Sato is operating the same way as is required by instant claim 1.

3) Finally, the assertion by the Examiner that "As the amperage of the device of Sato is increased from zero, there will be inherently a point at which TCNQ will function as a semiconductor" is addressed herein.

However, prior to addressing these points a brief summary of Sato and the materials and device disclosed in Sato and how they are capable of functioning is warranted.

The device of Sato is directed to an organic thin-film device which has a first organic thin film containing an acceptor molecule and a second organic thin film containing a donor molecule stacked on the first organic thin film. At least one of the organic thin films contains a chemical species having a dipole moment P_2. A dipole moment P_1 is produced by a charge transfer between the acceptor or donor molecules that satisfies a formula wherein a vector r represents a positional relationship between the dipole moments P_1 and P_2.

Sato teaches that the application of external energy, such as an electric field, voltage or light beam, results in a charge transfer between at least a part of the donor or acceptor molecules inside the organic thin film. This charge transfer causes a change in the absorption spectra or conductivity of the films, bringing about positive and negative polarities in the film, whereby functional devices

such as displays or rectifiers, switches or light memory devices are achieved. The explicit and stated goal of Sato is to provide devices of the aforementioned kind wherein the threshold value, i.e. the external potential that is causing the charge transfer, can be made as small as possible. The threshold value needed to cause a charge transfer is, according to Sato, strongly dependent on the orientation properties of the molecules and it is thus central to the teachings of the reference to provide acceptor or donor molecules with dipole moments oriented such that the charge transfer between the donor and acceptor molecule can be attained at a minimum threshold.

All of the examples of Sato concern displays. It is evident from col. **12-25** that neither the donors nor the acceptors of Sato function as semiconductors in the device of Sato, although some of the compounds could fall in the semiconductor range if their resistivity properties are considered. However, whether a compound is a "semiconductor" can not be considered in the abstract, but must be considered in the context of the surrounding materials and the device in which it is incorporated. Sato teach that the preferred donors may be fulvalene compounds or various sulfur-containing heterogenic donors including benzothiophene. Nowhere does Sato disclose the use of TCNQ

as a donor (which it cannot be). TCNQ is discussed in Sato at col. 19 (under item 8) as a cyano compound acceptor. However, this is contrary to the present invention, in which the active semiconductor itself can be a donor while the charge transfer compound can be an acceptor. In this case, TCNQ could not be used as a semiconductor.

As noted above, the Examiner's position is primarily based on the assertion that the device of Sato contains an element (TCNQ) that can act as a semiconductor in the device of Sato, thus achieving the invention. However, there is no evidence from the teachings of Sato that an element is present in the reference device that is capable of functioning as a semiconductor within the context of the device. As discussed above, whether a compound is a semiconductor cannot be considered in the abstract, but must be considered in the context of the device in which it is placed.

Nowhere does Sato teach specific switching and rectifying functions. Rather the reference teaches that the layer of an acceptor skeleton and the layer of a donor skeleton together can be switched at low voltages. In addition, electron transfer takes place from the donor to the acceptor and as in case of example 1, col. 6, lines 35 to 40 "when a bias voltage is applied to the super lattice

portion with a TTF side as the negative electrode and the TCNQ side as the positive electrode", electrons are transferred from the TTF skeleton to the TCNQ skeleton with resulting in a change in the light absorption characteristics in the super lattice structure portion. Thus, the display operation can be performed in a display device. In other words, in Sato, by biasing the cathode, electrons pass from the tetrathiofulvalene (TTF) skeleton into the TCNQ on the anode side. This amounts to say that biasing the device of Sato results in orientation effects in the super-lattice structure due to an injection of electrons in the acceptor skeleton; thus making it important to control the orientation properties of the molecules. However, this does not correspond to a change in the conductive state nor a switching of a semiconductor device. Nor is does the device of Sato display a photovoltaic behavior since the only thing that takes place is the alteration in the light absorption characteristics.

In summary, there is no disclosure Sato that the super lattice structure forming a charge-transfer complex in any sense can function as the active semiconductor layer of the present invention

As noted by the Examiner, Appellants have stated that TCNQ can have semiconducting properties. However, the

Examiner misconstrues Appellants' statement that TCNQ can have semiconducting properties as an admission that TCNQ can act as a semiconductor in the device of Sato. The Examiner is incorrect in this regard and Appellants would like to again clarify this point. While, a compound may have the potential to have semiconducting properties, whether or not it is a semiconductor can only be determined in the context of the device in which it is placed and the conditions under which it is used. TCNQ in the device of Sato does not and cannot be a semiconductor.

In this regard the Examiner appears to misunderstand the structure and function of the device of Sato. For instance the Examiner states at page 10 of Examiner's Answer, "As the amperage of the device of Sato is increased from zero, there will inherently be a point at which TCNQ will function as a semiconductor". However, this is a distortion of what Sato actually teaches and the reference by Sato to "amperage". The Examiner's misunderstanding of the reference teachings and technology is evidenced by the statement that "there inherently will be a point at which TCNQ will function as a semicondcutor". This statement is scientifically incorrect because the resistivity of TCNQ varies with the temperature. In addition, there is an applied potential at which TCNQ exhibits negative

resistance and passes almost instantly from a non-conducting to a strongly conducting state and with the device of Sato there is a potential threshold at which charge (electron) transfer occurs. However, "potential" is voltage, not current ("amperage"). It is the threshold potential that is relevant here, and a display action is obtained when this threshold potential is achieved.

The statement of the Examiner that "the prima facie case of anticipation would remain acceptable since the device of Sato would inherently be capable of meeting the claim", is in error since the charge transfer complex of Sato must be regarded in relation to the totality of the structure and the device of Sato cannot function as required by the present invention. Thus, contrary to the assertion by the Examiner, the present invention is not just a different use for the device of Sato. The device of Sato is neither structurally nor functionally the same as the present invention.

The specific points raise by the Examiner in the Examiner's Answer are addressed in the following additional remarks.

1) As discussed above, the crux of the Examiner's position appears to come down to a question of whether the device of Sato can used in the same way as the inventive

device, even if Sato does not disclose such use. Briefly, the answer to this question is "No".

The device of Sato is simply a charge transfer complex between two electrodes where the charge transfer complexes are formed and interact in such a manner that an external threshold potential leads to an electron transfer from a donor molecule skeleton molecule to an acceptor skeleton molecule, the latter being a TCNQ-based skeleton molecule. The device as distinctly disclosed in Sato and operated as a display device may change its light-absorption characteristics in the super-lattice structure formed by the charge transfer complex. An electrical switching is not disclosed. All this is known in the art as evident from the introduction of Sato. Since the active semiconductor in the present invention is distinct from a charge transfer compound, the complex being formed by the active semiconductor and the charge transfer compound and moreover the charge transfer compound are provided in a wholly different structural relationship than that shown in Sato. Sato does not disclose or suggest a transistor or a photovoltaic device and there is suggestion in Sato of how the device could be operated in this manner. Thus, the device of Sato cannot be used as a device of instant claim 1.

2) In connection with 1), above, the present Reply Brief also addresses the position that the TCNQ in the device of Sato is operating or can operate the same way as is required by instant claim 1. The TCNQ in the device of Sato is used in an acceptor skeleton to form the acceptor compound of a charge transfer complex. For example, in Example 1, the donor skeleton is formed by TTF as stated. A number of other compounds suitable for performing respectively donor and acceptor compounds in the charge transfer complex are also disclosed by Sato. The Examiner asserts that the TCNQ in the device of Sato would be capable of meeting the function of the active semiconductor in the present invention.

TCNQ complexes can be used as semiconducting devices in certain devices and thus, it is irrelevant whether TCNQ complexes could be used as the active semiconductor in the present invention. The issue is whether TCNQ can be a semiconductor in the device of Sato. As discussed above, whether TCNQ can act as a semiconductor cannot be considered in the abstract, it must be evaluated in the context of the device of Sato. The TCNQ does not and cannot behave as a semiconductor in Sato. Thus, in the context of the device of Sato, TCNQ does not meet the

feature of the active semiconductor of the present invention.

3) Finally, the assertion by the Examiner that "As the amperage of the device of Sato is increased from zero, there will be inherently a point at which TCNQ will function as a semiconductor" is addressed herein. The Examiner's evaluation of this feature of Sato is fundamentally in error. As a first point, Sato does not speak of amperage and the increase of amperage, but rather a threshold value of an external potential which produces the charge transfer causing the device of the reference to operate as a display device. However, as discussed above, this is a switching effect and does not make TCNQ function as a semiconductor.

In Sato, TCNQ is provided as an acceptor skeleton in a complex molecule and at a threshold voltage, the charge transfer complex causes in a change of the light absorption characteristics with a change in color occurring when the threshold voltages are exceeded. Thus, the Examiner's assertion is completely without foundation.

Summary

In summary, contrary to the assertion of the Examiner,

TCNQ cannot act as a semiconductor in the device of Sato. Thus, the present invention is not just a different use for the device of Sato. The device of Sato is neither structurally nor functionally the same as the present invention. The present invention is, therefore, not anticipated by or obvious over Sato.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By ma a
MaryAnne Armstrong, PhD., #40,069

P.O. Box 747
Falls Church, VA 22040-0747
(703)205-8000

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